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ABSTRACT

Our society is witnessing an ever-increasing sophistication in the development and use of computer and associated telecommunications technologies. Archivists are no longer faced with preserving relatively simply numeric files, but with maintaining a vast array of electronic information holdings ranging from complex databases to compound electronic documents composed of text, images, sound, graphics, and data. Although information in electronic form may offer several research advantages over paper records, archivists find preservation of and access to electronic records problematic for a variety of reasons: (1) electronic information is system dependent; (2) electronic information resides on fragile storage media; and (3) electronic information can be easily erased or changed. Archivists have devised several approaches to ensure the preservation of information in electronic form. These are: (1) archival involvement with information systems at their inception or design stage to ensure the availability of historically valuable electronic information; (2) the development and use of standards to ensure the transfer of data across fragile media and constantly changing technological environments; and (3) the development of interdisciplinary projects to test possible solutions that build upon others' expertise. Recommendations for five categories of activities to be supported during the coming years conclude this report. (11 references) (MAB)

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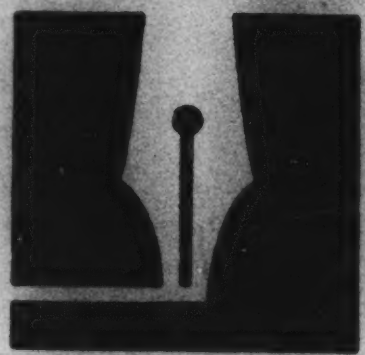

ELECTRONIC RECORDS ISSUES

A Report to the Commission

COMMISSION REPORTS AND PAPERS
NUMBER 4
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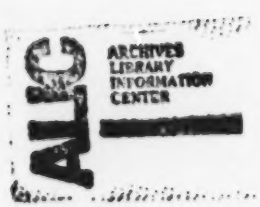
Preface

This report, *Electronic Records Issues*, is the fourth in a series of technical papers and reports prepared by the staff of the National Historical Publications and Records Commission (NHPRC). The series includes analytical and evaluative studies relating to Commission-sponsored projects, as well as research papers on topics of general interest to the archival and historical editing communities. Reports selected for inclusion in this series have been endorsed by the Commission for public distribution. *Electronic Records Issues* was written by Lisa B. Weber, Assistant Director for Technological Evaluation of the Commission's Records Program.

This technical series joins other Commission publications, such as the *Directory of Archives and Manuscript Repositories in the United States* (second edition, 1988), the *Historical Documentary Editions* catalog (1988), and *Annotation*, the NHPRC's newsletter, whose overall aim is to provide the public with information about historical research materials and Commission activities. It is hoped that these reports and papers will prove beneficial to a wide range of professionals in all disciplines embraced by the Commission and its work.



Executive Summary

Managing information in electronic form to ensure its availability for future use by a broad spectrum of users--including records creators, historians, social scientists, genealogists, journalists, lawyers, and private citizens--is the most significant and difficult challenge currently confronting the archival community.

Our society is witnessing an ever-increasing sophistication in the development and use of computer and associated telecommunications technologies. Archivists are no longer faced with preserving relatively simple numeric files, but with maintaining a vast array of electronic information holdings from complex databases to compound electronic documents composed of text, images, sound, graphics, and data. Although information in electronic form may offer several research advantages over paper records, archivists find preservation of and access to electronic records problematic for a variety of reasons: (1) electronic information is system dependent; (2) electronic information resides on fragile storage media; and (3) electronic information can be easily erased or changed. Moreover, unlike paper records, which can be neglected for some time with minimal deterioration, information in electronic form can be lost quickly. Assessment cannot take place retrospectively.

Archivists who have tried to address these issues have devised several approaches to ensure the long-term preservation of valuable information in electronic form. These are: (1) archival involvement with information systems at their inception or design stage to ensure the availability of historically valuable electronic information; (2) the development and use of standards to ensure the transfer of data across fragile media and constantly changing technological environments; and (3) the development of interdisciplinary projects to test possible solutions that build upon others' expertise.

Using a national conference as a planning mechanism to develop a research agenda and project priorities, Commission staff recommends that the following categories of activities be supported during the coming years:

1. Projects that support the inclusion of archival components as part of larger system designs to assure the preservation of historically valuable information.

2. Projects that assure the representation and participation by the archival and research communities in the development of standards and related activities that affect data management and preservation.

3. Educational activities such as workshops, courses, curriculum development, and training for strengthening archival capabilities for dealing with issues relating to electronic records systems.

4. Conferences and groups, to include members from a variety of fields, which focus on topics such as technology forecasting, records appraisal, legal issues, documentary editions in electronic form, federal information policy and its impact on the states, state information policies, and the impact of computing on the organization and use of information.

5. Projects to survey, acquire, preserve, and make available older data sets or data from systems that are presently in danger of loss.

Electronic Records Issues:

A Report to the Commission

Background

At its June 1989 meeting, the Records Committee of the National Historical Publications and Records Commission (NHPRC) charged the staff of the Records Program to develop a paper that explored the issues concerning electronic recordkeeping. The Records Committee's interest stemmed from the desire to see the Commission make electronic records a major focus for project funding. A draft of the paper was formally submitted to the Records Committee at its October 1989 meeting and informally distributed to the entire Commission. In November, the same draft was circulated to a large group of individuals representing a variety of constituencies. The review group included the NHPRC's State Historical Records Coordinators, archival experts in the area of electronic recordkeeping, archival educators, and government information officers.

Response to the draft was overwhelmingly positive. Commission staff received over twenty-five written replies. General support for the Commission's action and endorsement of the specific recommendations was unanimous. Moreover, all the replies contained thoughtful comments and suggestions. The final report incorporates the majority of the suggestions that the reviewers recommended.

The Commission discussed the report at its February 1990 meeting and voted unanimously to endorse its recommendations. Several Commission members suggested including projects concerning documentary publications in electronic form as an additional topic. Discussion of the report focused on ensuring that the Commission receives the types of electronic records proposals it considers important to fund. Staff suggested that, as a first step, the Commission support a national planning effort to develop a research agenda and project priorities. The development of such a research agenda was supported by the Society of American Archivists' (SAA) Committee on Goals and Priorities (CGAP) in its 1988 Commission-funded report entitled "An Action Agenda for the Archival Profession: Institutionalizing the Planning Process."

The purpose of the national invitational conference would be to develop a plan of work for the next three to five years by examining and discussing a prepared list of questions about electronic records issues that need to be answered, along with ideas for possible projects to address those questions. The participants would include not only archivists but interested groups such as users, resource allocators, information resource policy makers, and members of allied professions. The conference agenda, the list of questions and possible projects, and the list of invitees would be developed in coordination with groups already involved in electronic records issues such as the National Association

of Government Archives and Records Administrators (NAGARA), SAA, the Association for Information and Image Management (AIIM), and the Association of Records Managers and Administrators (ARMA). Commission staff suggested that the conference be held in early December of 1990. This would enable applicants to build on the conference recommendations and develop proposals for submission against the Commission's June 1991 deadline.

Introduction

Our world is increasingly relying on automated technology to carry out our daily activities. This dramatic change, which began in the 1950s, has accelerated at a phenomenal rate. It is of major concern to archivists and to historians and other users of archival materials. In 1985, the Committee on the Records of Government, comprising users of public records, categorically stated that "[t]he danger of losing historically valuable records is greatly increased by the changeover to electronic recordkeeping."[1]

The 1989 National Academy of Public Administration's (NAPA) report, entitled *The Effects of Electronic Recordkeeping on the Historical Record of the U.S. Government*, commissioned by the National Archives and Records Administration (NARA), concluded that "a number of factors are at work that imperil the historical record."[2] The National Association of Government Archives and Records Administrators' (NAGARA) June 1989 institute focusing on archival administration and electronic records concluded that "[t]he archival management of electronic records is probably the most important, and certainly the most complicated, issue currently before the archival profession."[3] In fact, providing long-term access to information in electronic form is as important for citizens' rights and government accountability as it is to ensure the protection of and access to our documentary heritage. The need for finding successful means to cope with electronic records systems is becoming increasingly urgent.

Commission staff members agree that managing electronic records systems to ensure their availability for future use is the most significant and difficult challenge currently confronting the archival community. This paper will examine issues and problems associated with electronic recordkeeping, look at possible approaches and obstacles for managing the records to provide optimum access, review major activities in the field, and present a series of recommendations for consideration.

Issues and Problems

Technical Aspects

Our society is witnessing ever-increasing sophistication in the development and use of computer and associated telecommunications technologies. In the 1960s and 1970s, a few archivists chose to confront the management of computer-generated data of a statistical, technical, or scientific nature. Although information in computer format was ignored by most archivists, some archivists and others, such as social science data librarians, developed methods to provide access to these primarily numeric files. Nonetheless, very few traditional archives instituted programs to provide access to computer data files.

Subsequently, the level of complexity of computer and telecommunications technologies and the sophistication of computer applications have increased dramatically, presenting archivists with far more challenging problems. Existing methods developed in the 1970s for handling computer files do not address the current situation, let alone anticipate what lies ahead. Archivists are no longer faced with preserving relatively simple numeric files, but with maintaining complex databases and compound documents composed of text, images, sound, graphics, and data. Often these sophisticated databases and document management systems have relationships with other equally complex electronic records. As the NAPA report states, "an electronic document is not so much a 'thing' as it is a set of relationships . . . No longer are archivists and historians working with objects but with processes."[4]

At the same time, archivists, historians, social scientists and others recognize that information in electronic form offers certain advantages. Electronic records are compact, thus alleviating the enormous storage problems that voluminous paper records pose. Information in electronic form is more readily accessible because of automated information retrieval techniques. It is also easily manipulated to promote more effective research use. Furthermore, electronic records can be duplicated easily, thereby offering the potential of wider distribution of archival materials.

Nonetheless, archivists find electronic records problematic for a variety of reasons: (1) electronic information is system dependent; (2) electronic information resides on fragile storage media; and (3) electronic information can be easily erased or changed.

(1) System dependency

Electronic information is a series of impulses or signals which has no meaning to the human senses without first being transformed into human-readable form by technology. Once decoded, these signals represent text, data, graphics, sound, or images. Our understanding of information in electronic form is dependent upon hardware (the physical equipment of the computer), software (the instructions which operate the computer and manipulate the data), the processes used to gather and manipulate information, and the documentation created to explain the context within which the information was created, managed, and used.

We are totally dependent upon constantly changing computer technology to be able to understand and use electronic information. Concomitantly, users have no control over the development or the continued availability of that technology. A highly competitive marketplace drives its creation and sales. New products and services are introduced at a startling pace--older products and services are regularly withdrawn or discontinued. Hardware can become obsolete as soon as five years after its introduction. Software can become obsolete in three years or less. The result of this situation is that archivists must try to preserve and provide access for users to electronic information that relies upon constantly changing, market-driven technologies over which they have no control.

System dependency also encompasses the documentation required to understand the data in electronic form. Documentation refers to the complete description of the collection, organization, processing, and presentation of data in a computer system. Without such information, the data is virtually unintelligible to a potential user. Unfortunately, it is all too common for documentation not to exist, which renders the electronic data useless.

(2) Storage media

Electronic information is stored on a variety of fragile media that are also produced in the same highly competitive marketplace. Magnetic tape, floppy disks, and hard disks all use the same basic technology which causes metal particles to be magnetized in desired directions and utilizes playback mechanisms to "read" those impulses or signals. Preserving this fragile medium is a complex task. No magnetic medium is considered "archival" and under optimal conditions magnetic tape (which archivists consider the most stable of the magnetic media) cannot be expected to last more than twelve to twenty years. All data on magnetic media must be transferred to new magnetic tape periodically with yearly maintenance routines conducted to measure deterioration of the data. Proper and consistent environmental controls are also required to increase longevity. Additionally, magnetic media are sensitive to dirt, smoke, magnetic fields, and external pressure.

Optical disks use a different technology for electronic information storage and retrieval in which a laser beam creates and reads microscopic impressions on the disk. Because these physical impressions are more durable and stable than magnetic impulses, vendors claim that optical disks have a longer "shelf-life" than magnetic tape--from ten to one hundred years. Optical disks are also considered less susceptible to deterioration due to environmental conditions. Although they may be more durable than magnetic storage media, they are also not considered an archival medium.

But unlike eye-readable materials, the longevity of the media is not the only preservation consideration. More important is the availability of the hardware and software required to decode the electronic information. Regardless of the "shelf-life" of magnetic or optical media, when the hardware and software become obsolete, the electronic information is utterly inaccessible.

(3) Ease of change and loss of electronic information

Information in electronic form permits easy alteration of data without leaving any evidence and allows the deletion of massive amounts of information with minimal effort. In fact, the ease of change is often seen as beneficial. In a democracy, accountability of government, corporate, and individual activities for public scrutiny is required. Therefore, electronic recordkeeping systems must ensure audit trails as well as the authenticity of documents. In addition, historians and other researchers need successive drafts and versions of documents to analyze processes and events. The transitory nature of electronic information is distressing and the potential for loss or change creates an array of problems far more complex than those presented by paper-based systems.

These three areas cause archivists--and subsequently users--considerable problems. Unlike paper records, which can be neglected for some time with minimal deterioration, information in electronic form will be lost quickly due to obsolescence, negligence, ignorance, or intent. Assessment cannot take place retrospectively. The Committee on the Records of Government concluded that "records created on tapes or disks are erased or lost before anyone exercises judgment about their possible value. In addition, given the rapidity of technological change, even information recognized as valuable can be lost because the equipment and skills necessary to retrieve it become obsolete or unavailable."[5] Margaret Hedstrom, historian, archivist, and nationally recognized expert on electronic records, believes that "archival institutions must focus their attention on current electronic

records, perhaps concluding that they were too late in dealing with earlier electronic information systems."[6]

Greater Complexity Raises New Issues

In the 1970s a handful of archivists developed methods to preserve and provide access to less complex forms of electronic information. They were able to find solutions to many problems because the computer technology and applications they chose to address were relatively simple. But computer use is now rampant and additional and more sophisticated applications are being developed every day. Furthermore, the decentralization of technology caused by the explosion in the use of microcomputer systems has greatly exacerbated the magnitude and complexity of the problems. Complex databases comprised of text, data, graphics, images, and sound are running on all sizes of computer systems. The applications supported by computers in the office have evolved from basic word processing to applications that automate business procedures and change the way that business functions are managed. Image applications are rapidly expanding into a variety of areas, the most well-known being in science and engineering. For example, engineers use computer-aided design (CAD) systems to create a myriad of products. The development of geographic information systems (GIS) is also explosive. This increasing complexity raises fundamental questions that archivists must face to ensure that valuable information stored in electronic form is available for purposes of public accountability and for historians and other users of primary research materials to exploit.

One fundamental issue that is raised is the definition of a record. Both the NAPA report and the NAGARA institute recognized that archivists must examine and refine the legal definition of a record in the context of electronic technology. "[T]he nature of electronic information [is that it] 'resides' in different parts of different databases. This information may simply be a 'view' of a database or a portion of one at an ephemeral point in time. 'Views' of a database along with other developments . . . undermine . . . the model of a discrete entity that is a record."[7]

The need to redefine a record is not the only fundamental question electronic recordkeeping raises. Other questions include, how does electronic recordkeeping challenge traditional archival principles such as provenance and original order? How should archivists conduct the appraisal of electronic records? How is the legality of electronic records assured when the concept of "original" record is called into question because it is impossible to distinguish physically between the "real" record and a modified electronic copy? Since changing and erasing information without leaving any evidence is possible, how is the security of electronic information ensured? How does one provide for privacy and confidentiality of the information? How and in what form should electronic information be provided to an increasingly computer-literate research community? Those attending the NAGARA institute concluded that "[d]ealing with electronic records leads to a fundamental re-thinking of other aspects of archival administration and the management of archival institutions."[8]

Approaches

Although the obstacles that exist for archivists to preserve and provide access to electronic information are enormous, they are not insurmountable. The primary strategy upon which everyone agrees is that archivists must take an active approach and not wait

to take action at the conclusion of the active life of electronic records systems. Archivists must acquire the knowledge and develop the expertise to become involved in the system development life cycle to ensure that information of archival value is preserved. But how to develop successfully and implement this strategy is not yet clear. For example, archivists have discussed several approaches regarding the timing of the initial appraisal of electronic records--before or at the time of creation. There have also been discussions about who should have the authority to appraise electronic records: archivists, records managers, or even the creators themselves.[9] Nonetheless, archivists agree that the fundamental strategy of their involvement with information systems at the design stage is required if the availability of any historically valuable electronic information is to be ensured in the future.

The development and use of standards is a second approach that archivists agree the profession must pursue to foster access to electronic information.[10] It is impossible for archival repositories to become warehouses of obsolescent hardware, software, and media in order to provide access to electronic information. An alternative is to transfer continually or to migrate data across media and records systems to assure that they can be used in a constantly changing technological environment. Fortunately, archivists are not the only group interested in data transfer. Manufacturers and vendors know that data transfer is crucial to their success in the marketplace. Vendors must be able to assure users that machines can communicate with each other and that data put into current systems will not have to be reentered into new ones. Driven by vendors and government, national and international standards development currently taking place within the computer hardware, software, and telecommunications fields includes standards for media, operating systems, methods of recording data in storage devices, and methods of transferring data. Standards development is an extremely intensive, lengthy, and costly process. Thus far, the interests of the archival and historical communities have not been represented in these standards setting activities. But if we are to ensure the availability of information in electronic form in the future, archival and user concerns must be strongly represented in future standards development.

A third approach is an interdisciplinary one. There is a variety of national and international activities concerning the creation, management, preservation, and access to electronic records systems taking place among a diverse group of professions. Research is underway in the disciplines of information and library science, sociology of organizations, computer science, management science, and engineering which attests to the fact that archivists and historians are not alone in their concern for the problems of long-term preservation and access to information in electronic form. Lawyers, accountants, program managers, and information resource management professionals are also concerned with many of these issues.[11] Given the overlapping interests in these problem areas, there is great potential for building alliances among a number of professions and interest groups. What is needed are interdisciplinary projects to test possible solutions to these problems that build upon the expertise of many different professional communities and interest groups.

Obstacles

In addition to the enormous technical problems raised by information in electronic form, archivists must face a vast array of larger political and economic issues. The prospect of archivists participating in system design, standards development, and

interdisciplinary projects is logical, but not uncomplicated. The politics of getting archivists involved in these activities is the first challenge and the difficulties encountered in doing so are related to the archivist's traditionally perceived role as passive custodian and to a general feeling of being undervalued by colleagues. Where do archivists fit into the larger scheme? How do archivists get invited to the planning table when their typical role has been one of clean-up? Strategies and approaches that provide archivists with the tools to position themselves better in complex organizations to address electronic recordkeeping issues are desperately needed.

The economics of participation can also be viewed as an obstacle. Involvement by archivists in these new forums will not be cheap. For example, the complexity of developing multiple standards translates into high costs as do the resources required to create, test, refine, and upgrade archival components of electronic records systems. Finding the resources to put these solutions into practice is difficult. At the same time, most archivists do not perceive that they have valuable and unique expertise to bring to the planning and standards tables that includes understanding information in context, the ability to identify what is valuable, and experience in preserving and making information available. Problems associated with the lack of this expertise and awareness are becoming more obvious in the realm of current records. State governments are finding that the inability to provide access to information in electronic form created as recently as five years ago is undermining their ability to protect citizens' rights.[12] Archivists can use their expertise as political capital to increase their influence and participation. But concrete resources in the form of money must also be available to solve problems.

Projects Currently Underway

Although there is a tremendous amount of work yet to be done, archivists and others are grappling with these issues. In addition to the three independent reports already cited in this paper, the Commission has or is currently funding electronic records projects in Wisconsin, Kentucky, New York, and Florida. The Research and Evaluation Staff of NARA is involved in a study of the role of standards in the creation, processing, storage, access, and permanent storage of electronic records.[13] NARA's newly created Center for Electronic Records is extending its scope beyond preserving numeric data files. Massachusetts recently hosted a conference on computerized public records and state Freedom of Information Act (FOIA) administrators.[14] The National Association for State Information Systems has just published a national study on state government information resources management.[15] Several state archives have produced white papers, reports, and plans concerning various aspects of managing electronic records. These activities attest to the fact that archivists and other information professionals are seriously concerned about administering information in electronic form and making it available to users in the future, but it is clear from all the reports that no one has the answers and people want and need help in trying to find viable solutions.

Recommended Action

In its introduction, the NAPA report states that "the recommendations . . . are not meant for NARA alone. What became increasingly clear . . . was that no single agency, and no single constituency, will be able to solve all the problems or take advantage of all the opportunities offered by electronic technologies. The sound management of

electronically generated records will require a coordinated federal effort, assisted by non-federal constituencies and the private sector."[16] The NAPA report goes on to recommend that "NARA should initiate, pursue, and support vigorous research programs--both within its own agency and without. It should utilize the NHPRC and its recommendations to the U.S. Archivist to foster research outside NARA . . ."[17]

Commission staff unhesitatingly concurs with this recommendation. The need is urgent. We must assist in the development of programs to foster the preservation of and access to information in electronic form. The Commission should take an active role in supporting projects that move appropriate professional groups and institutions closer to finding workable solutions. If not, key documentation of the late 20th and early 21st centuries will be lost, leaving voids in the evidence that is so critical for piecing together an understanding of the past and the present.

While the Commission should encourage these projects, staff recognizes that limited resources restrict the ability of the Commission to support all current or future needs. Staff also appreciates that the Commission needs to provide continuing support for the many other categories of projects which receive Commission funding. Accordingly, staff suggests that the Commission fund, as one of its initial efforts, a national planning conference to develop a research agenda and priorities for electronic records projects. Considering the enormity of the universe of electronic recordkeeping issues and the limited resources with which the Commission and the archival and historical communities must work, support for the preparation of a plan of work is crucial. It will help to ensure that the subsequent projects the Commission funds will be successful and provide all concerned with meaningful answers.

In order to advance the Commission's work in the area of electronic records, we recommend that the following types of activities be supported during the coming years. Using the national conference as a planning mechanism, staff will work actively with appropriate organizations to foster the development of specific projects and will provide continuing evaluation of the projects to ensure the most efficient and effective use of Commission funds. These categories of activities include:

1. **Projects that support the inclusion of archival components as part of larger system designs to assure the preservation of historically valuable information.**

For example, archivists need to learn new ways of defining appraisal strategies in advance of system design. Such strategies will require continued testing, analysis, refinement, and upgrading. Other projects could focus on downloading archival data from an entire database or archival applications of the Information Resource Directory System (IRDS) standard which defines and maintains descriptive data or metadata (information about the structure and function of the system) about databases. Other projects should focus on complex database applications, office automation applications, and specialized applications such as geographic data and imaging systems. Projects should also develop strategies and approaches that provide archivists with the tools to better position themselves in complex organizations to address electronic recordkeeping.

2. **Projects that assure the representation and participation by the archival and research communities in the development of standards and related activities that affect data management and preservation.**

Consistent and sustained effort must take place in the appropriate standard-setting arenas.

3. **Educational activities such as workshops, courses, curriculum development, and training for strengthening archival capabilities for dealing with issues relating to electronic records systems.**

It is no longer possible for a few specialists in the archival and historical professions to be responsible for the problems and possible solutions associated with electronic records. All archivists must assume this responsibility and the profession needs to provide a variety of educational opportunities. Educational activities that increase awareness of these issues among allied professions, users, and the general public should also be supported.

4. **Conferences and groups, to include members from a variety of fields, which focus on topics such as technology forecasting, records appraisal, legal issues, documentary editions in electronic form, federal information policy and its impact on the states, state information policies, and the impact of computing on the organization and use of information.**

These fields should include archives, records management, information resources management, documentary editing, history, information and library science, sociology, computer science, management science, law, engineering, and hardware/software development, manufacturing, and sales. The products of these meetings should be publications which can be distributed to a broad audience.

5. **Projects to survey, acquire, preserve, and make available older data sets or data from systems that are presently in danger of loss.**

Although Hedstrom suggests that we may be too late in dealing with older electronic records system, some Commission support should be given to systematically studying the problem and suggesting approaches to handling this backlog. Nonetheless, a balance must be struck between saving information in older, badly designed systems and fostering the development of archival components for future systems.

Additional copies of this report may be obtained by writing to the Records Program, NHPRC (NPR), National Archives Building, Washington, DC 20408, or by calling (202) 523-5386, (202) 501-5610 after April 15, 1990. The Commission staff welcomes comments on the report from all readers.

Notes

1. Committee on the Records of Government, *Report* [sponsored by the American Council of Learned Societies, Social Science Research Council, and the Council on Library Resources] (Washington, D.C.: n.p., 1985), 10.

2. National Academy of Public Administration (NAPA), *The Effects of Electronic Recordkeeping on the Historical Record of the U.S. Government: A Report for the National Archives and Records Administration* (Washington, D.C.: NAPA, 1989), iii.

3. National Association of Government Archives and Records Administrators (NAGARA), *Archival Administration in the Electronic Age: An Advanced Institute for Government Archivists* [Co-sponsored by the School of Library and Information Science, University of Pittsburgh and funded by the Council on Library Resources] (Pittsburgh: NAGARA, 1989), 16.

4. NAPA, 31.

5. *Ibid.,* 10.

6. NAGARA, 6.

7. Charles M. Dollar and Thomas E. Weir, "Archival Administration, Records Management, and Computer Data Exchange Standards: An Intersection of Practices," draft typescript, Research and Evaluation Staff, NARA, 1989, 7.

8. NAGARA, 16.

9. David Bearman, *Electronic Records Guidelines: A Manual for Policy Development and Implementation* (Pittsburgh: Archives and Museum Informatics, 1989), 54-60.

10. National Institute of Standards and Technology (NIST), "Framework and Policy Recommendations for the Exchange and Preservation of Electronic Records," prepared for the National Archives and Records Administration (Washington, D.C.: NIST, 1989), 2.

11. U.S. Congress, Office of Technology Assessment (OTA), *Informing the Nation: Federal Information Dissemination in an Electronic Age* (Washington, D.C.: OTA, 1988).

12. Sharon Dawes, Executive Director of the New York State Forum for Information Resource Management, correspondence with Lisa B. Weber, December 5, 1989.

13. National Archives and Records Administration, "A National Archives and Records Administration Strategy for the Creation, Transfer, Access, and Long-Term Storage of Electronic Records of the Federal Government," draft typescript, Research and Evaluation Staff, NARA, 1989.

14. Office of the Massachusetts Secretary of State, *Report of the First National Conference on Issues Concerning Computerized Public Records* (Boston: Office of the Massachusetts Secretary of State, 1987).

15. Sharon L. Caudle and Donald A. Marchand, *Managing Information Resources: New Directions In State Government* (Syracuse: School of Information Studies, Syracuse University, 1989).

16. NAPA, 1.

17. *Ibid.*, 9.